US005606341A

United States Patent [19]

Aguilera

[11] Patent Number: 5,606,341

[45] Date of Patent: Feb. 25, 1997

[54] **PASSIVE CPU COOLING AND LCD HEATING FOR A LAPTOP COMPUTER**

[75] Inventor: **Rafael E. Aguilera**, Simpsonville, S.C.

[73] Assignee: **NCR Corporation**, Dayton, Ohio

[21] Appl. No.: **538,104**

[22] Filed: **Oct. 2, 1995**

[51] **Int. Cl.**[6] **H05K 7/20**; G02F 1/133

[52] **U.S. Cl.** **345/87**; 359/214; 361/699; 361/701; 361/718; 349/161

[58] **Field of Search** 345/214, 901, 345/87; 364/708.1; 359/49, 48, 86, 44, 43; 165/104.21; 315/112; 361/699, 701, 714, 718, 719

[56] **References Cited**

U.S. PATENT DOCUMENTS

Re. 29,833	11/1978	Mlavsky	136/89
3,889,053	6/1975	Lloyd et al.	178/6
4,838,664	6/1989	Graham	350/351
4,987,289	1/1991	Bishop et al.	219/209
5,119,215	6/1992	Marks et al.	359/44
5,247,374	9/1993	Terada	359/44
5,255,109	10/1993	Klein	359/43
5,285,351	2/1994	Ikeda	361/699
5,383,340	1/1995	Larson et al.	364/708.1
5,394,936	3/1995	Budelman	165/104.33

Primary Examiner—Mark R. Powell
Attorney, Agent, or Firm—Michael A. Kaufman

[57] **ABSTRACT**

In a laptop computer, CPU-generated heat is thermally conducted passively to a radiator-like element disposed behind the LCD, which uses the heat to warm the LCD. The CPU is surrounded by a liquid-tight housing containing a biphase coolant. A first tube in fluid communication with an outlet port in the housing conveys heat-vaporized coolant to an input port on the radiator. The coolant flows through a plurality of columns formed in the radiator-like element, transferring heat and condensing in the process. The transferred heat is radiated to the LCD, which is desirably warmed in the process. The condensed coolant is conducted from an export port in the radiator-like element through a second tube to an input port in the housing. A pressure sensor may be included to provide a coolant pressure drop signal that can be used to shutdown the CPU in the event of a coolant leak.

20 Claims, 5 Drawing Sheets